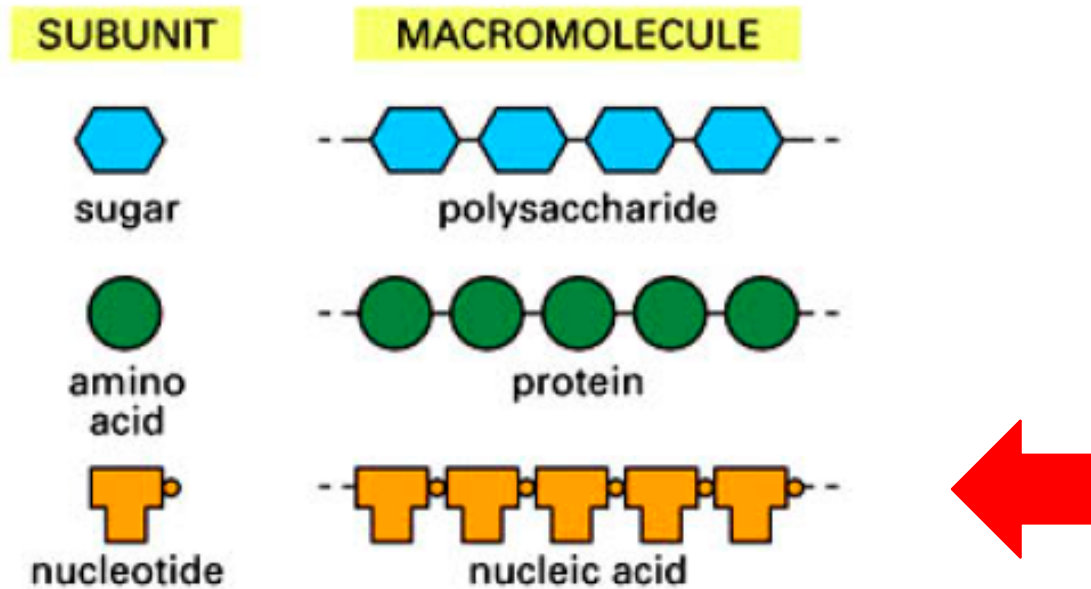


Macromolecules made of subunits

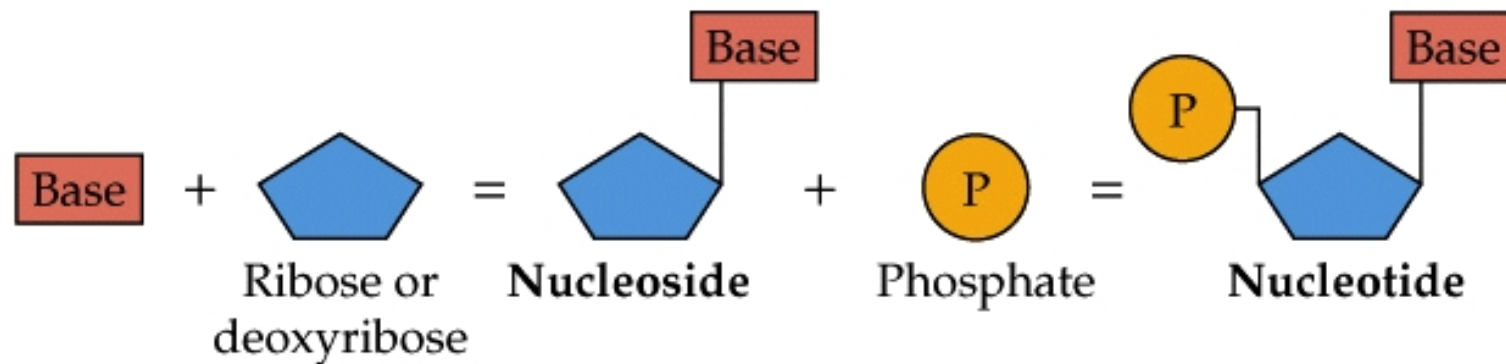


(Lipids are not polymers)

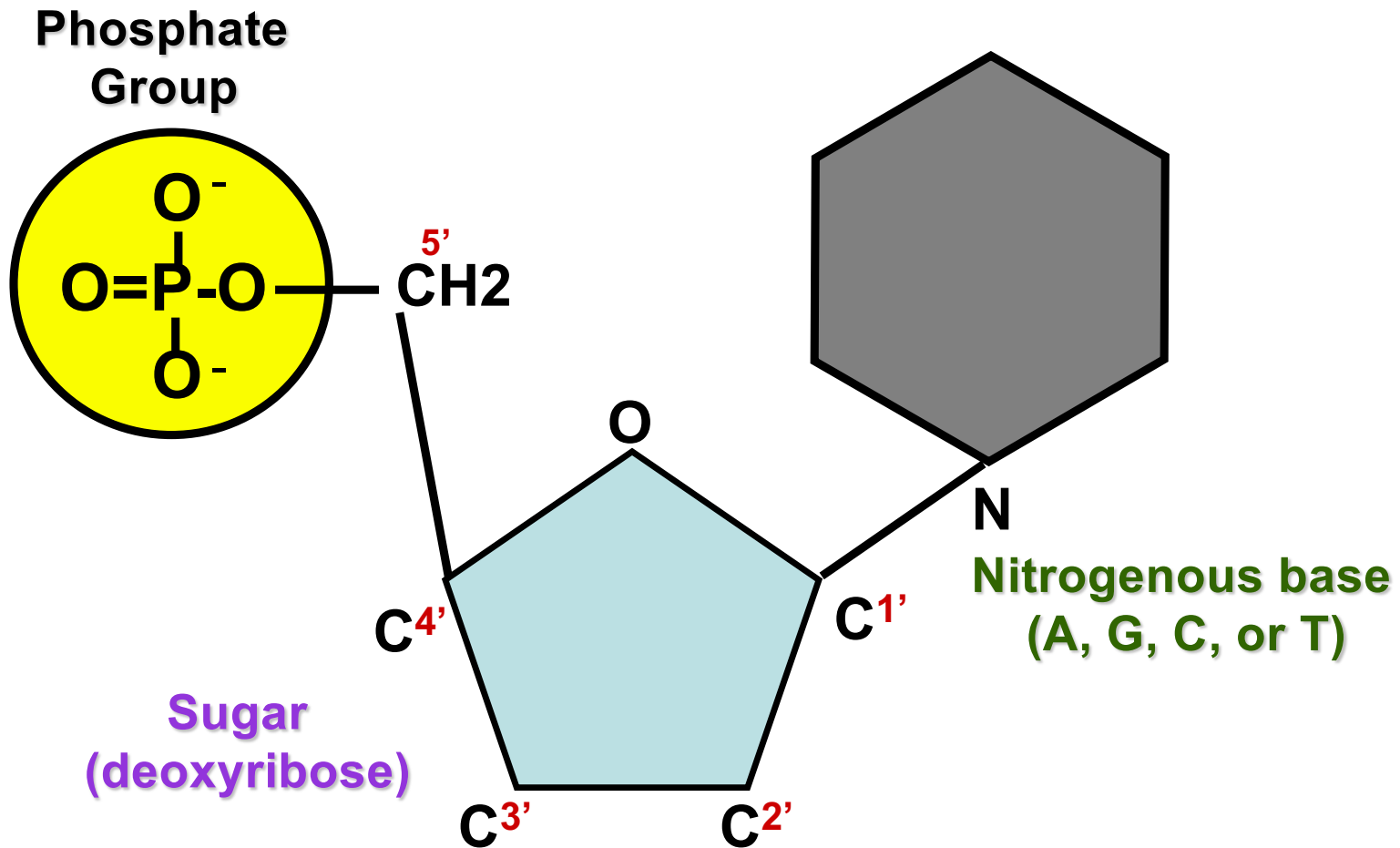
Nucleic Acids

A D N

A R N



Nucleotide



General structure of nucleotides

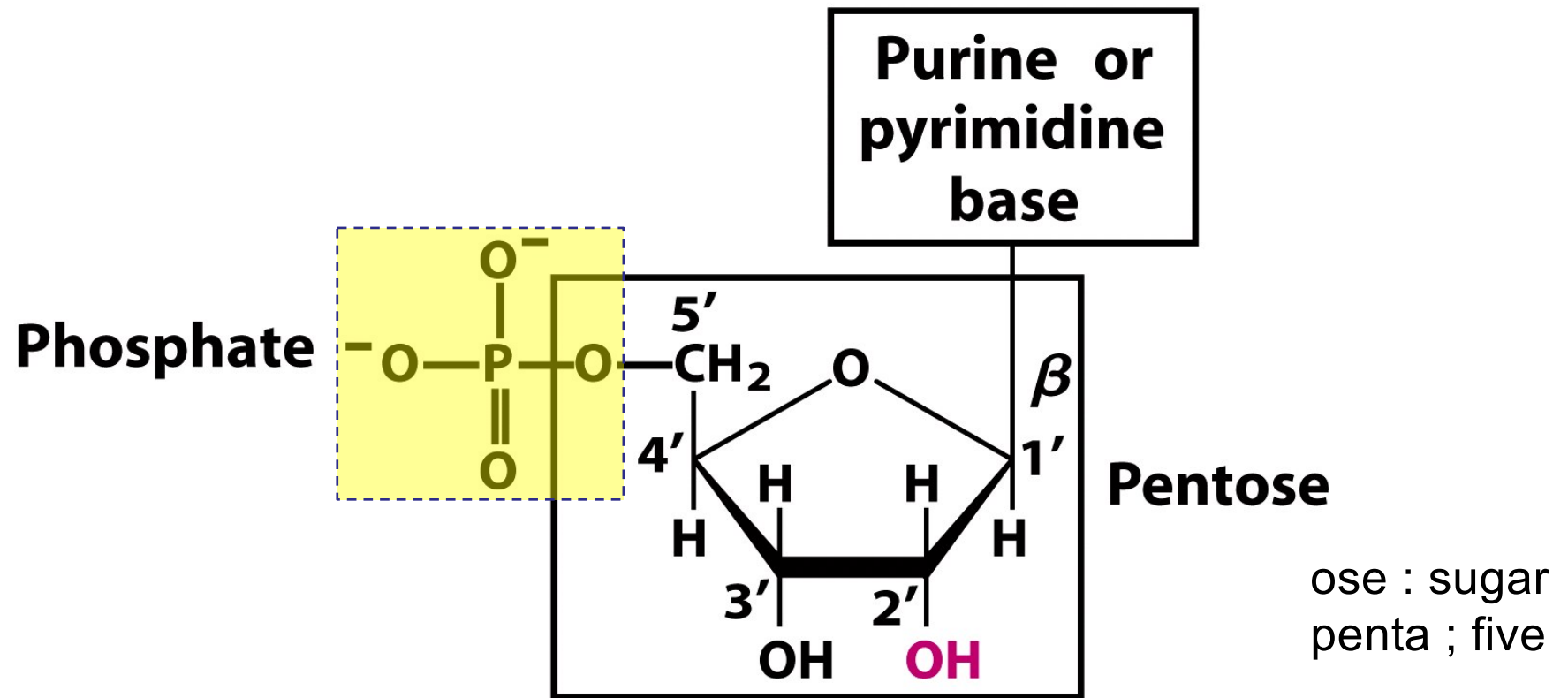
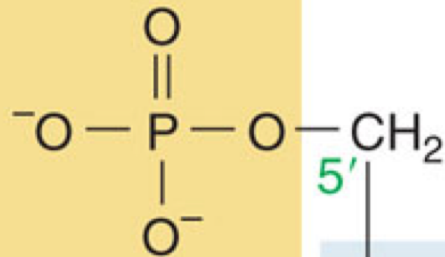


Figure 8-1a
Lehninger Principles of Biochemistry, Fifth Edition
© 2008 W. H. Freeman and Company

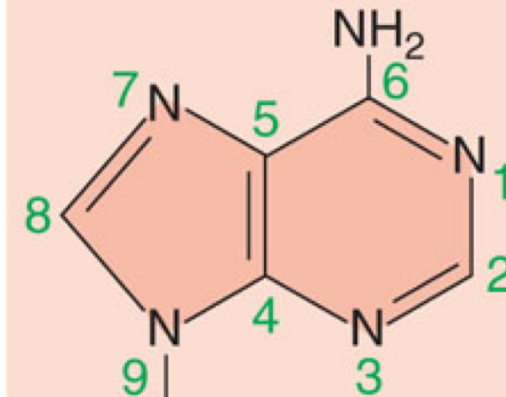
the numbering convention for the
pentose ring

General structure of nucleotides

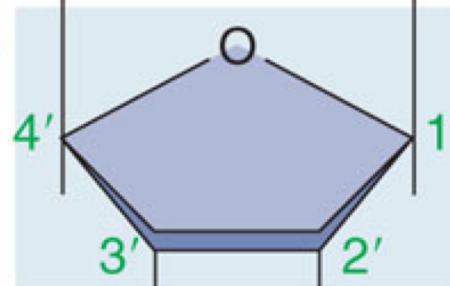
Phosphate group



Nitrogenous base



Numbering without prime



OH

R

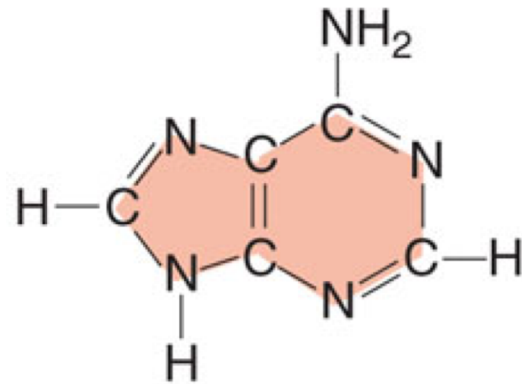
Sugar

OH in RNA

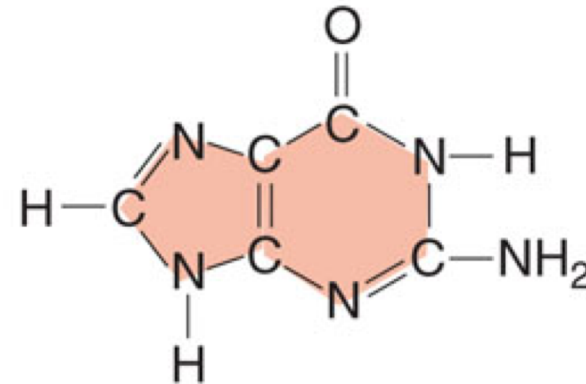
H in DNA

Nitrogenous bases

Large : purine

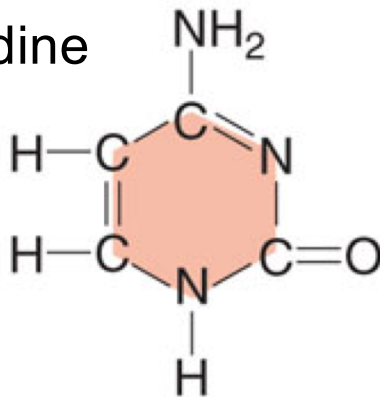


Adenine

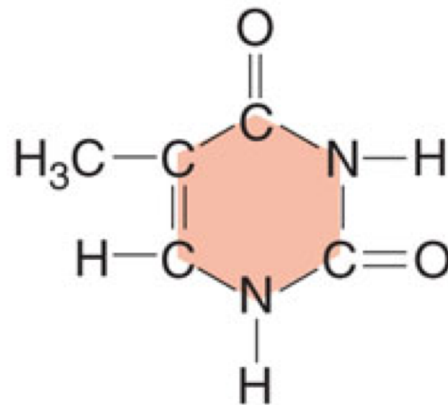


Guanine

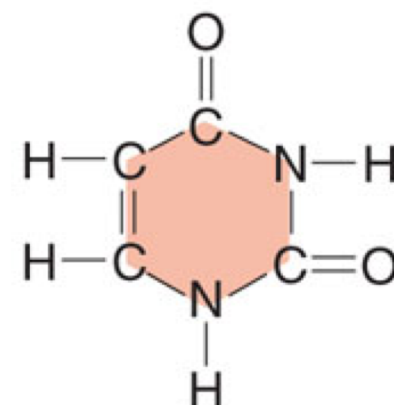
Small : pyrimidine



Cytosine

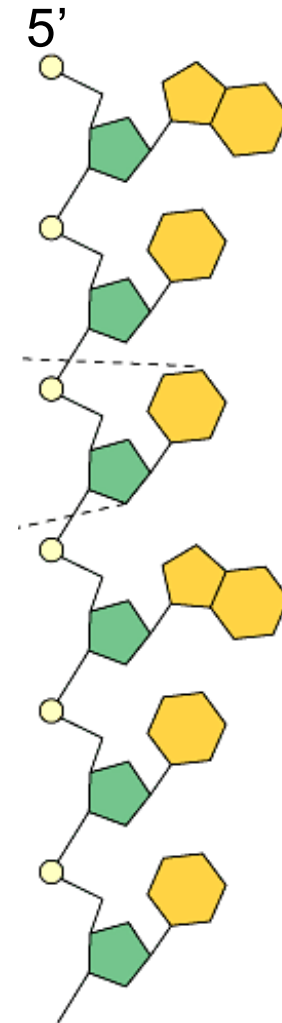


Thymine (DNA only)



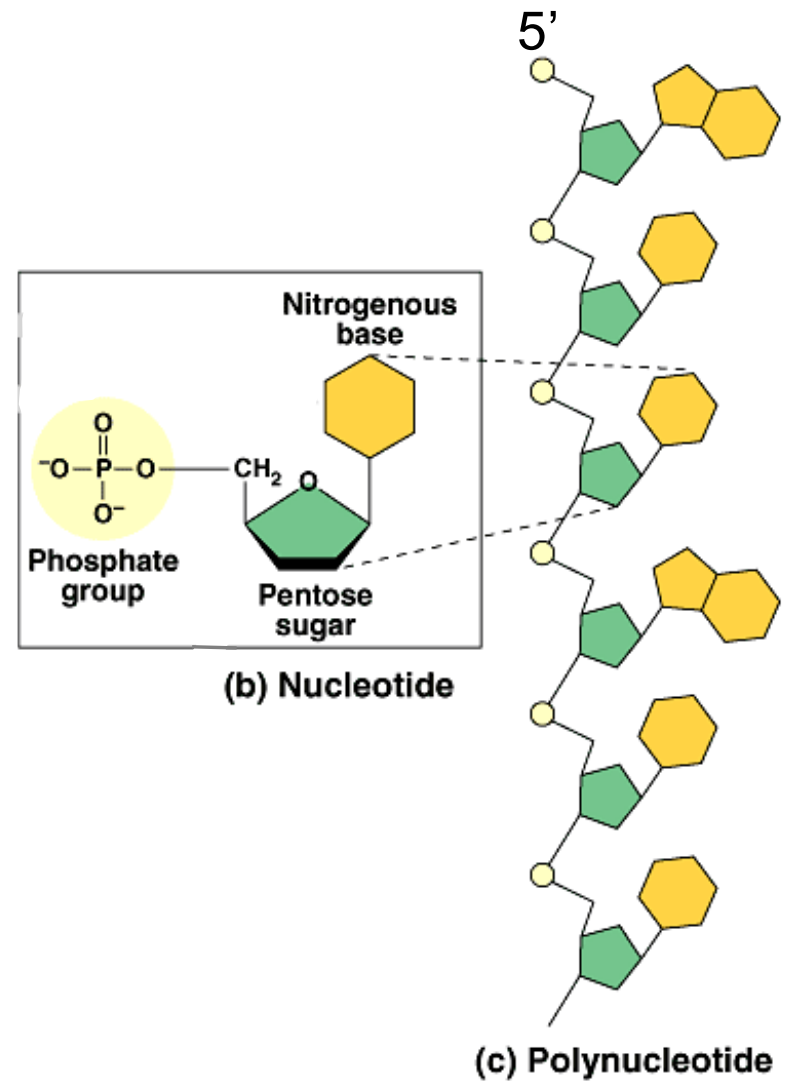
Uracil (RNA only)

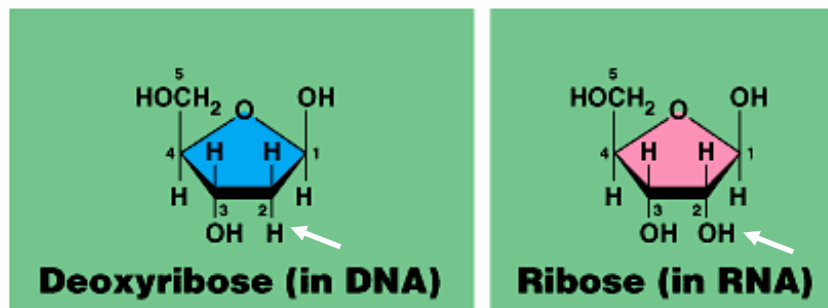
A nucleic acid strand :



(c) Polynucleotide

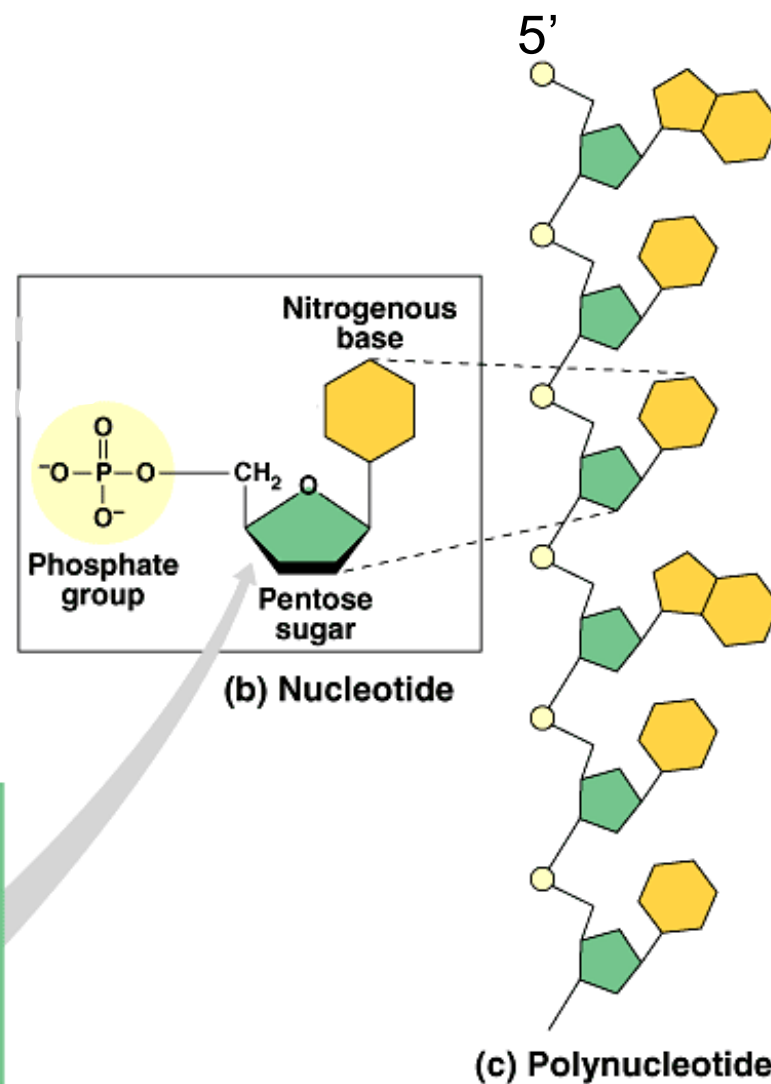
From Campbell



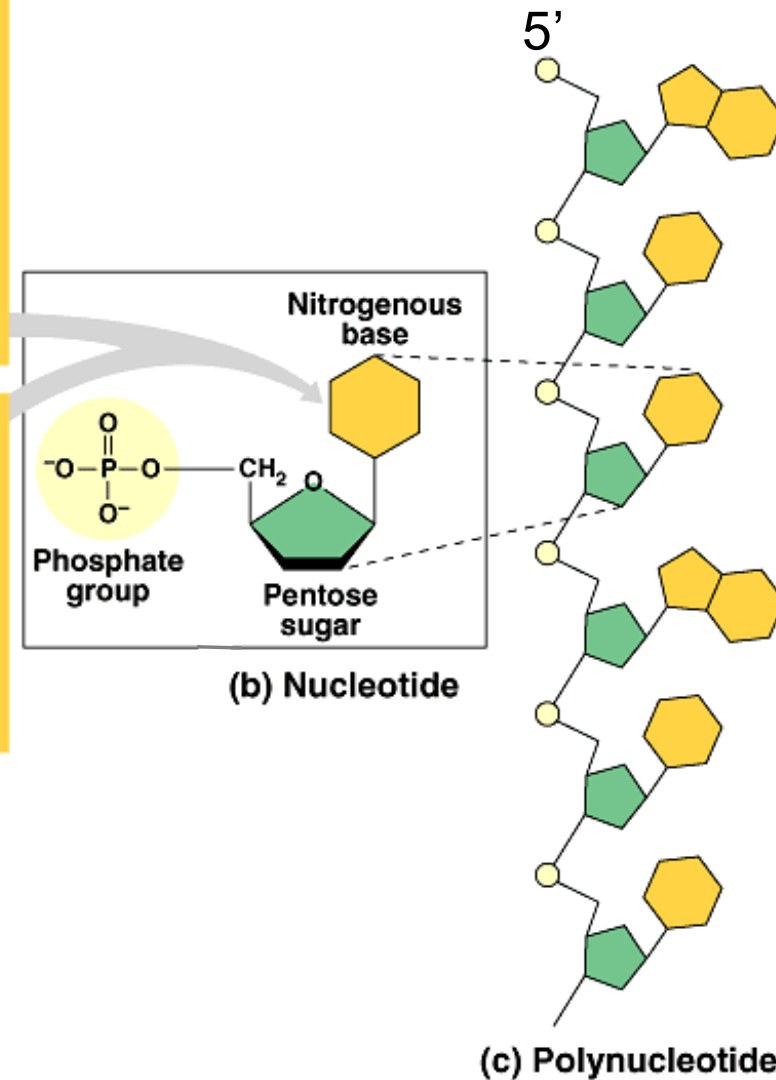
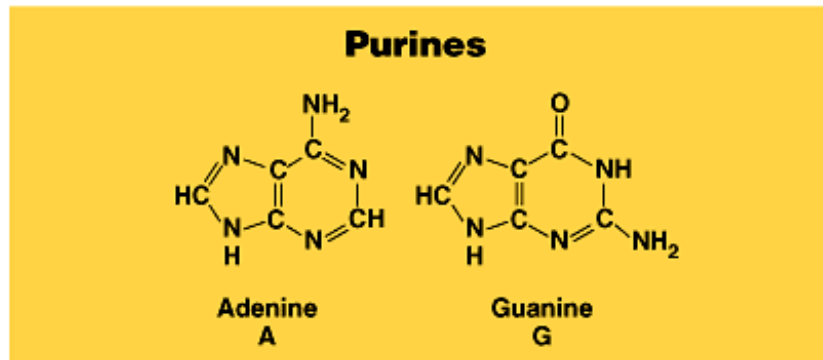
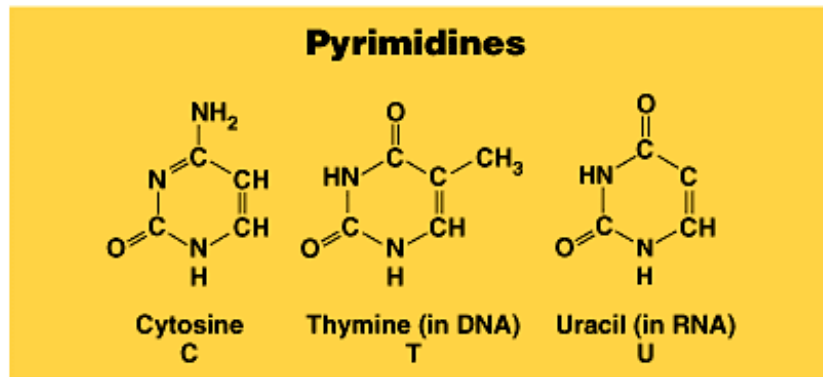


(a) Nucleotide components

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From Campbell

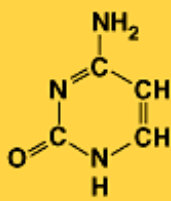


(a) Nucleotide components

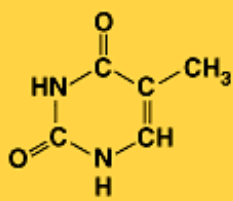
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From Campbell

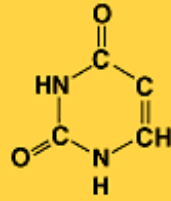
Pyrimidines



Cytosine
C

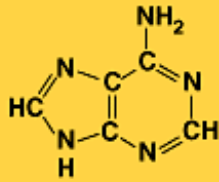


Thymine (in DNA)
T

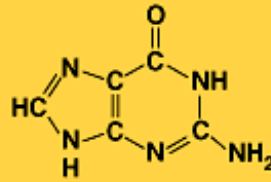


Uracil (in RNA)
U

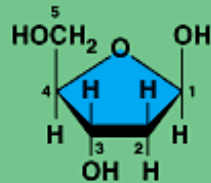
Purines



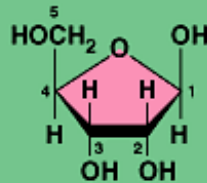
Adenine
A



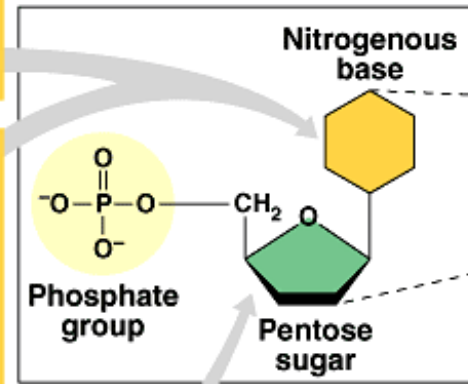
Guanine
G



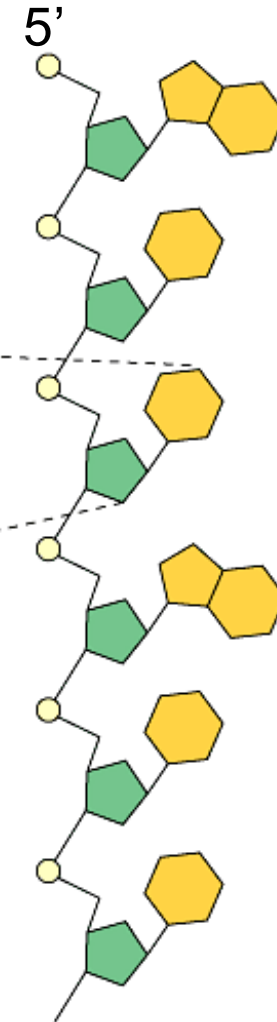
Deoxyribose (in DNA)



Ribose (in RNA)



(b) Nucleotide



(c) Polynucleotide

(a) Nucleotide components

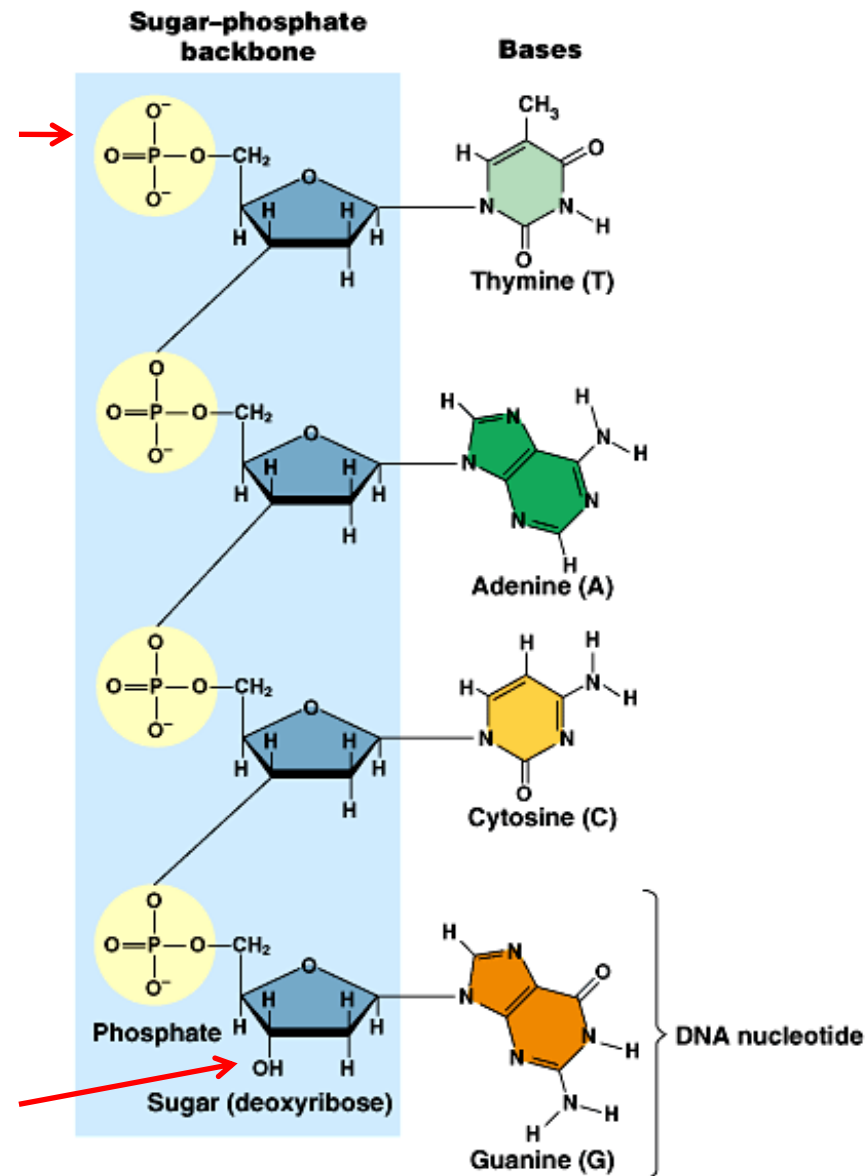
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From Campbell

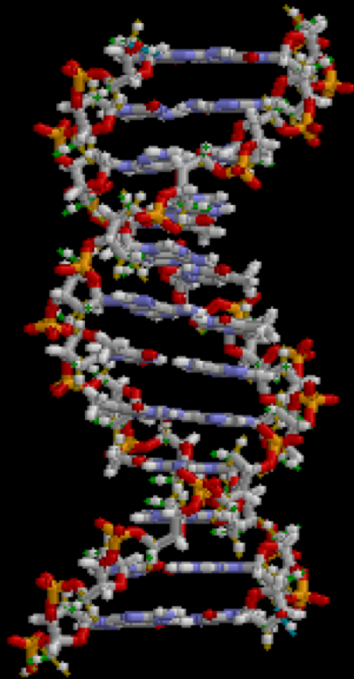
5' phosphate end

Polarity of nucleic acid strands :

3' OH end



DNA



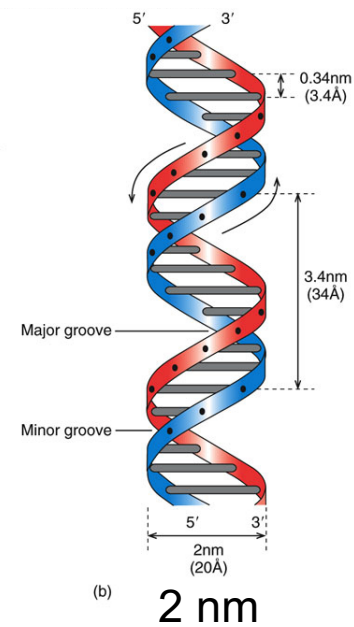
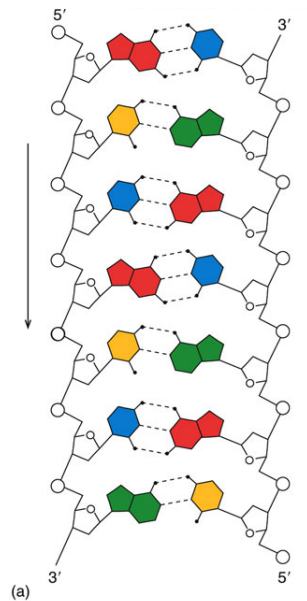
Deoxyribo

Nucleic

Acid

DNA :

The 2 strands are
complementary
antiparallel

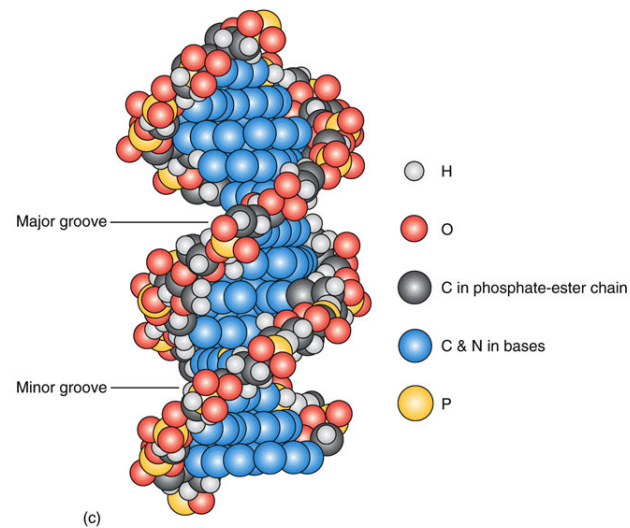


0.34 nm

Note the sizes

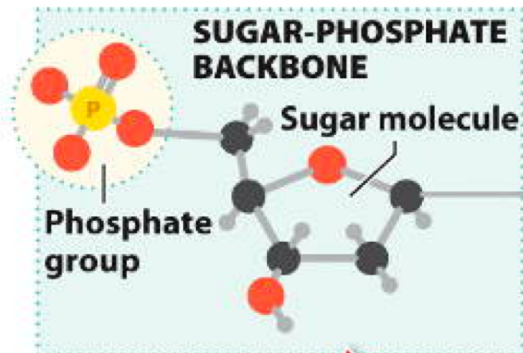
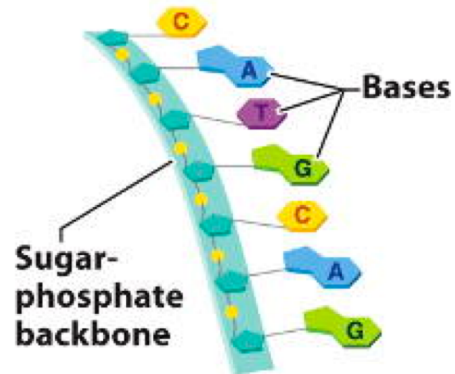
Major groove

Minor groove



NUCLEIC ACIDS

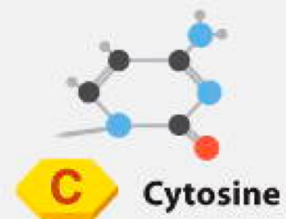
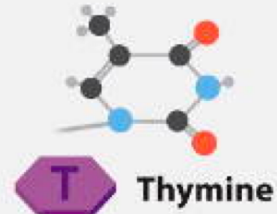
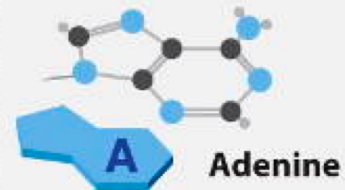
NUCLEIC ACID STRUCTURE



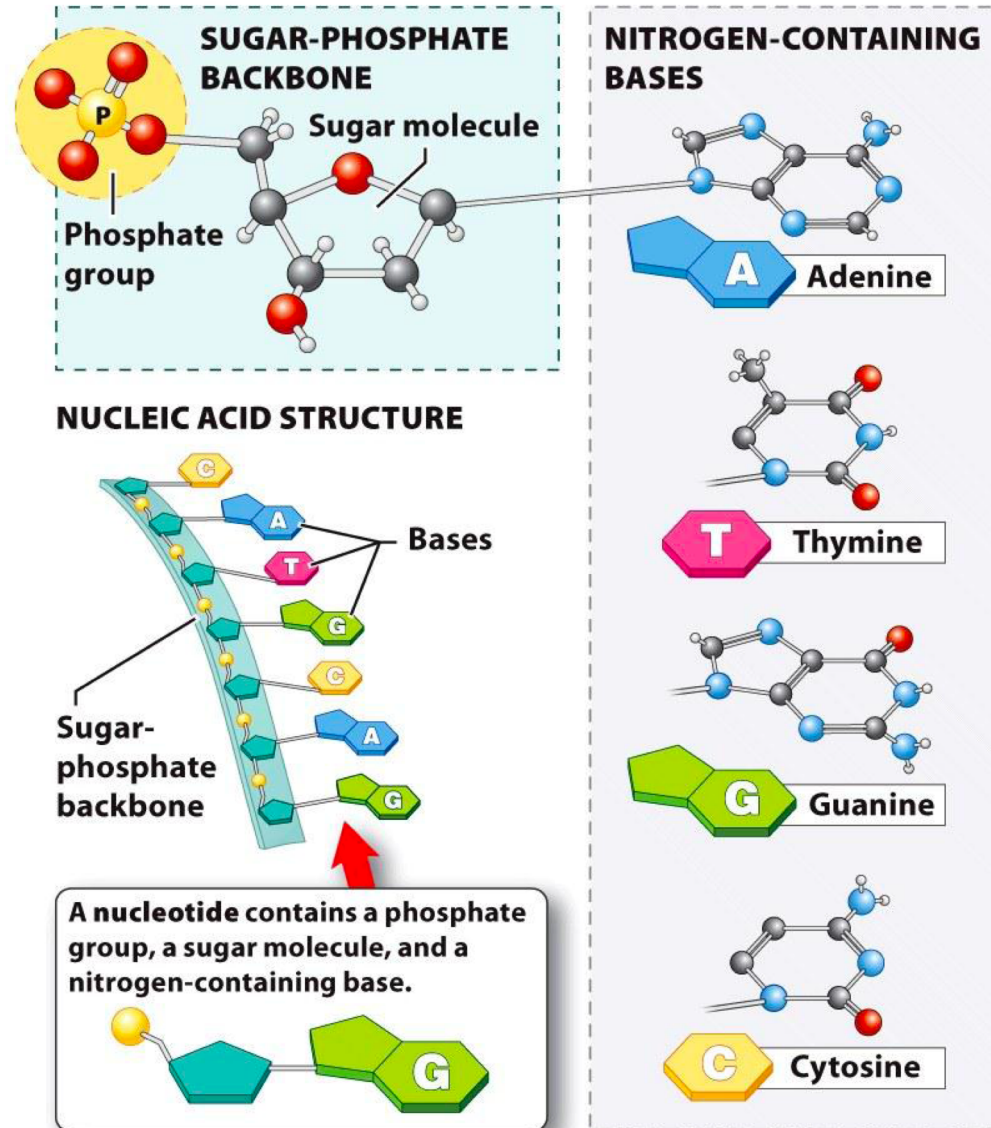
A nucleotide contains a phosphate group, a sugar molecule, and a nitrogen-containing base.



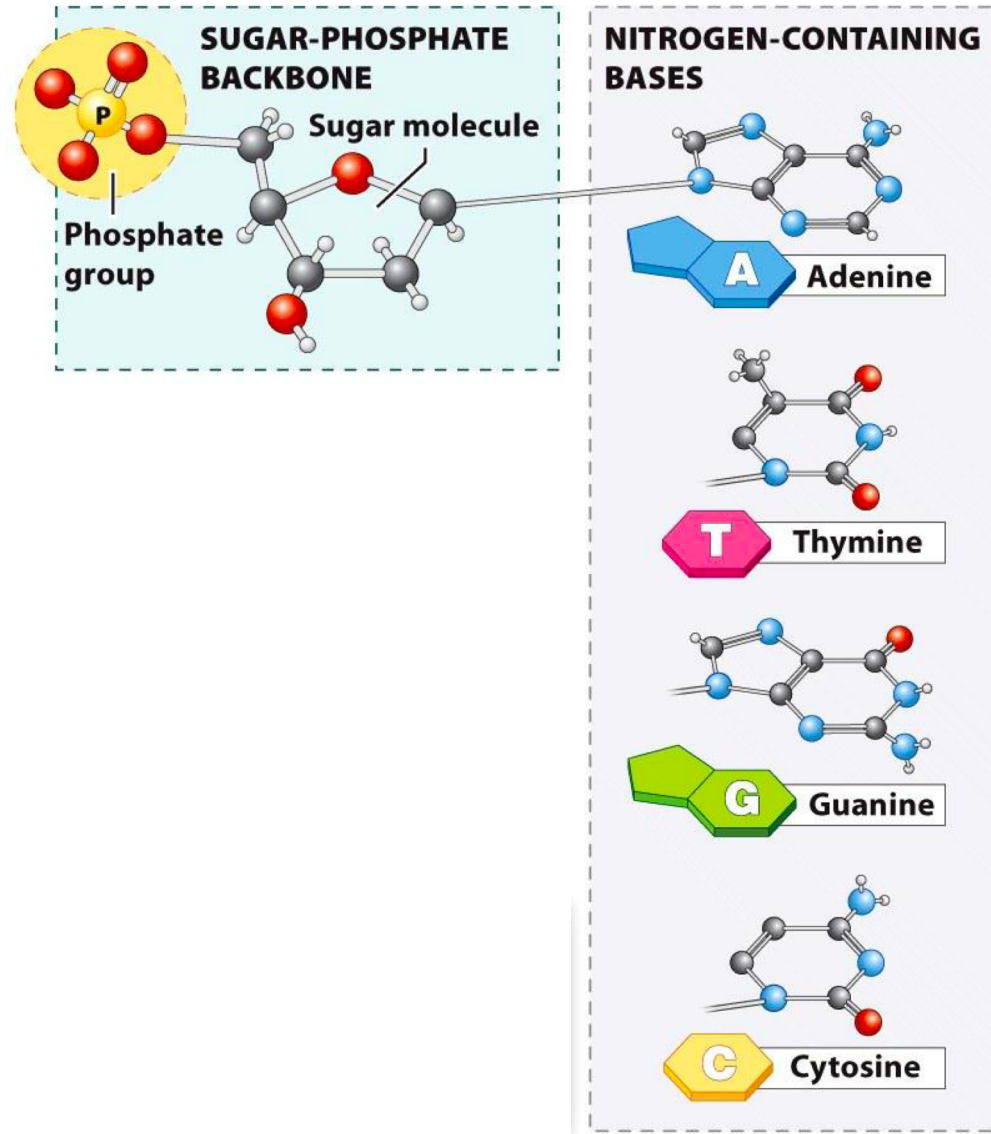
NITROGEN-CONTAINING BASES



NUCLEIC ACIDS (IN DNA)



NUCLEIC ACIDS (IN DNA)

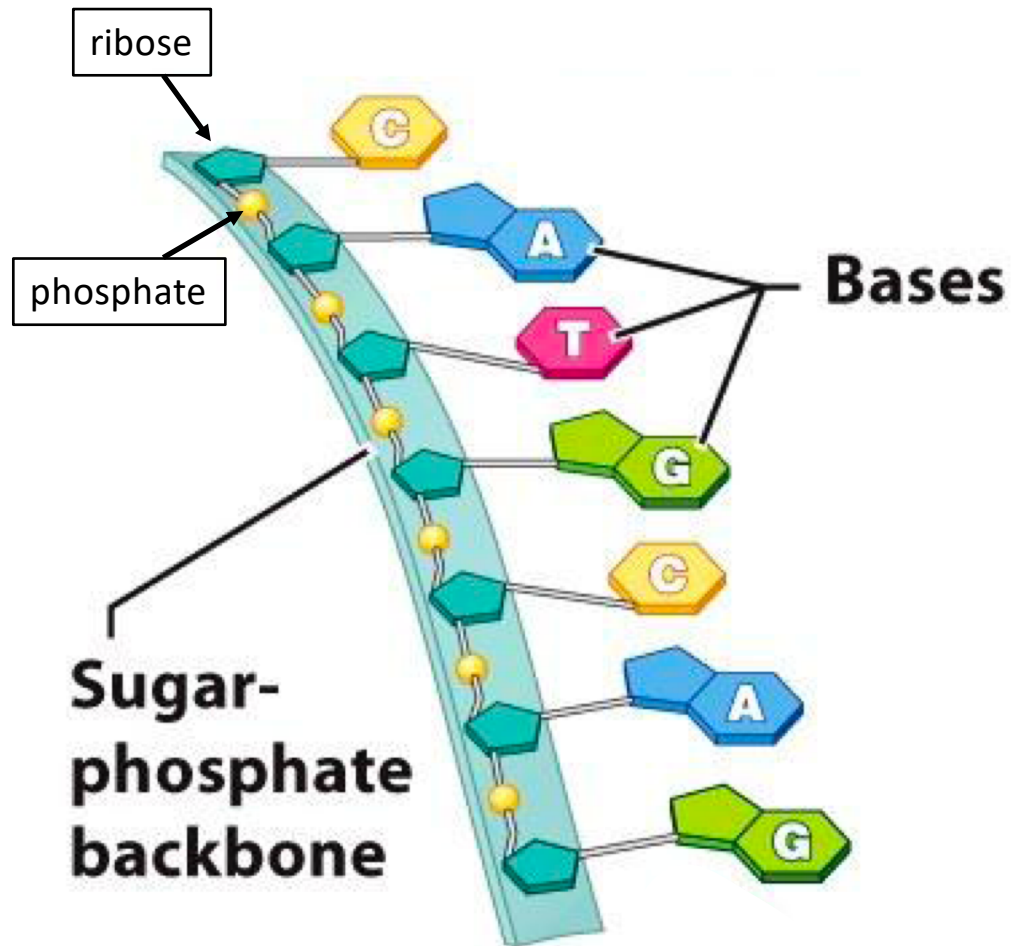


Purine

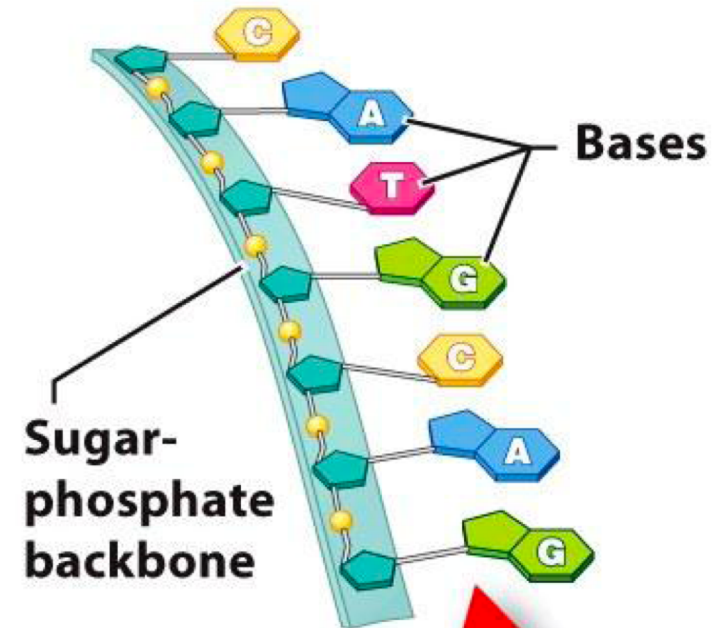
Pyrimidine

Purine

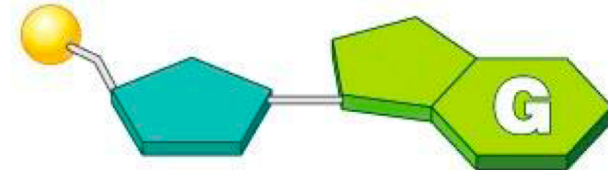
Pyrimidine



NUCLEIC ACID STRUCTURE

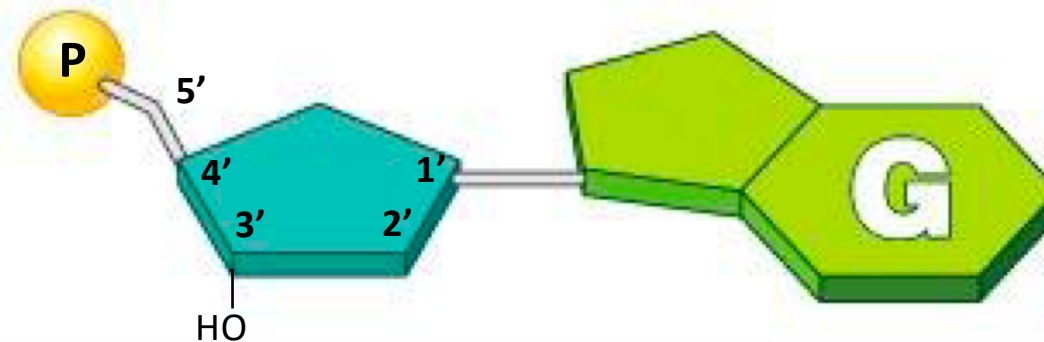


A nucleotide contains a phosphate group, a sugar molecule, and a nitrogen-containing base.

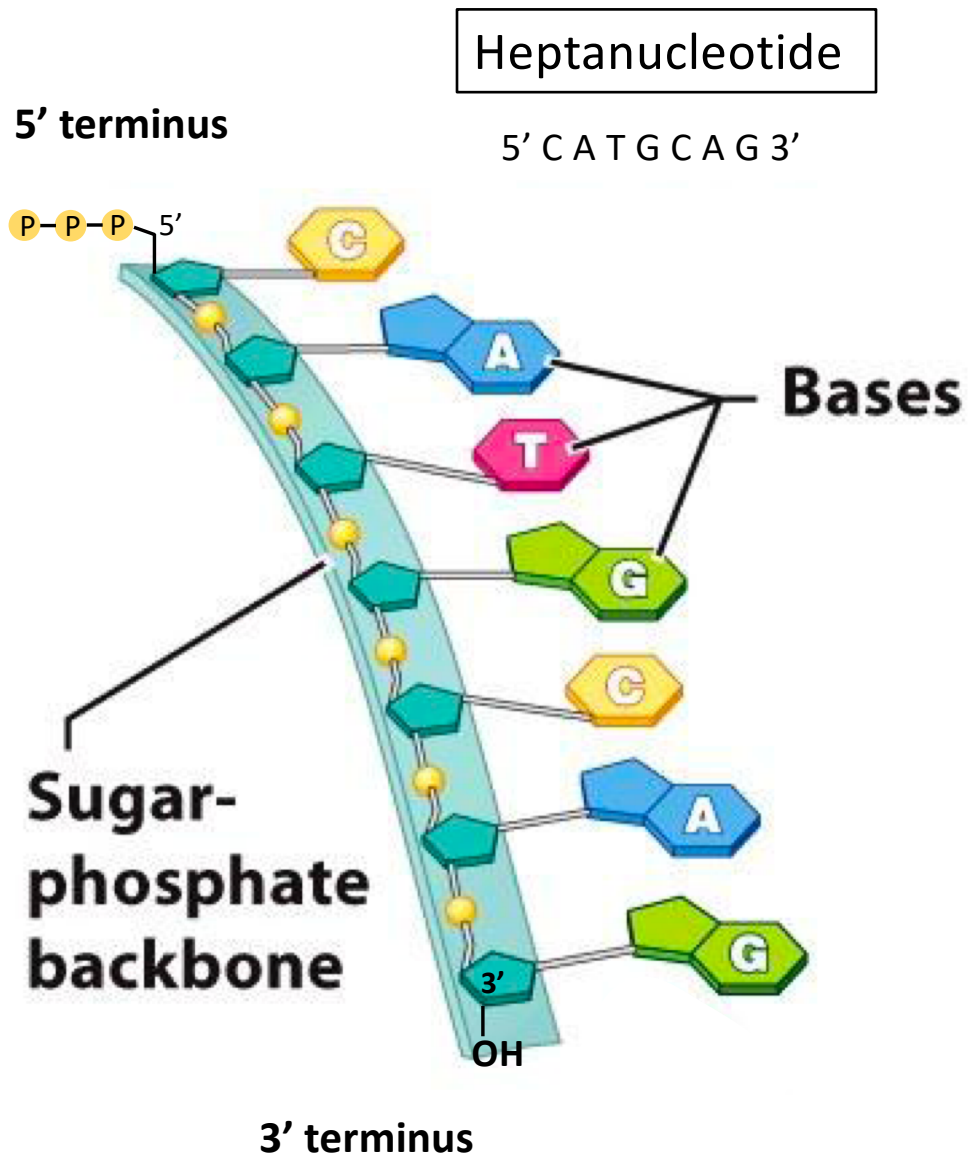


Ribose carbons are numbered from 1' to 5'.

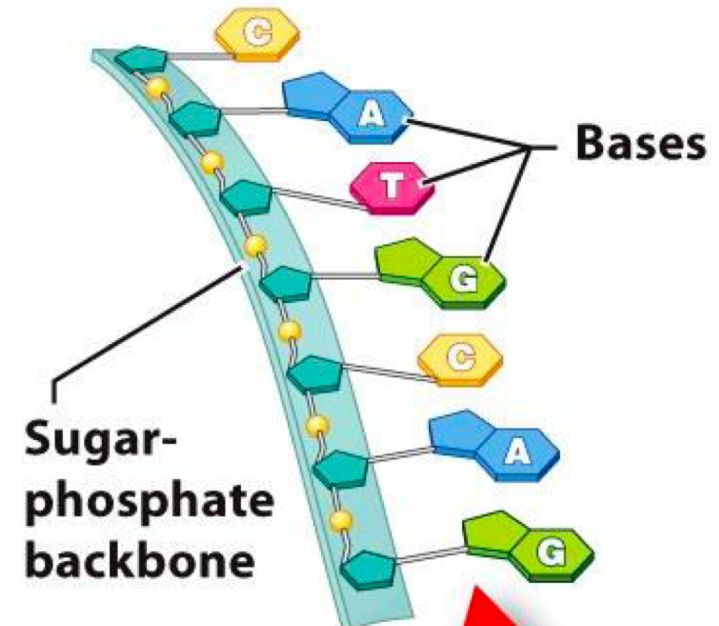
A nucleotide contains a phosphate group, a sugar molecule, and a nitrogen-containing base.



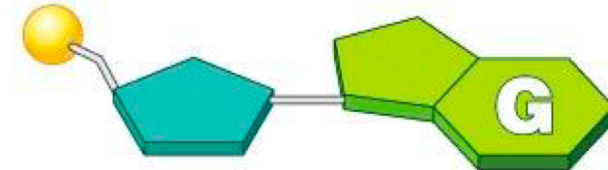
Pentose = 5-carbon sugar



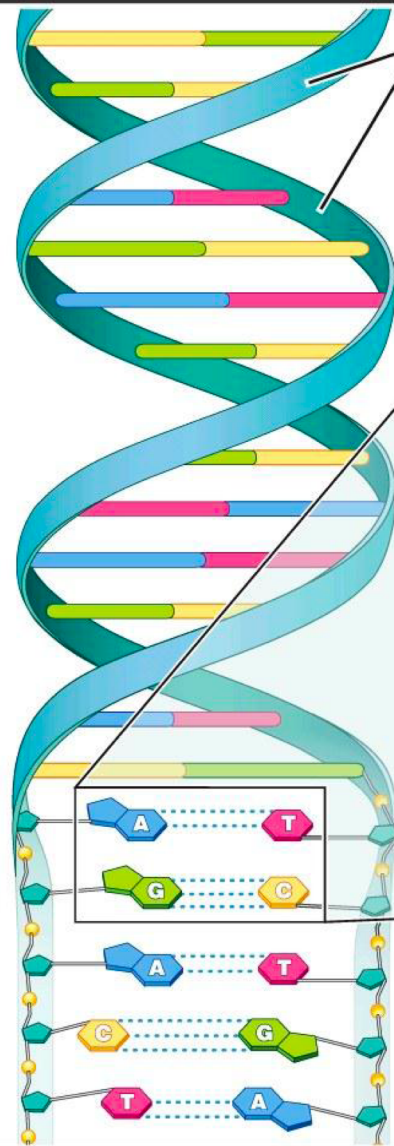
NUCLEIC ACID STRUCTURE



A nucleotide contains a phosphate group, a sugar molecule, and a nitrogen-containing base.



DEOXYRIBONUCLEIC ACID (DNA)

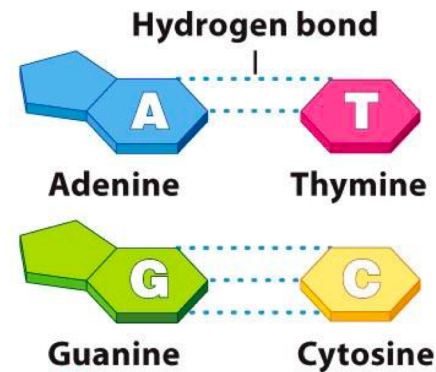


DOUBLE HELIX

Two sugar-phosphate backbones spiral around each other, forming the vertical structure of DNA. They are connected by the bases sticking out from their sugar molecules.

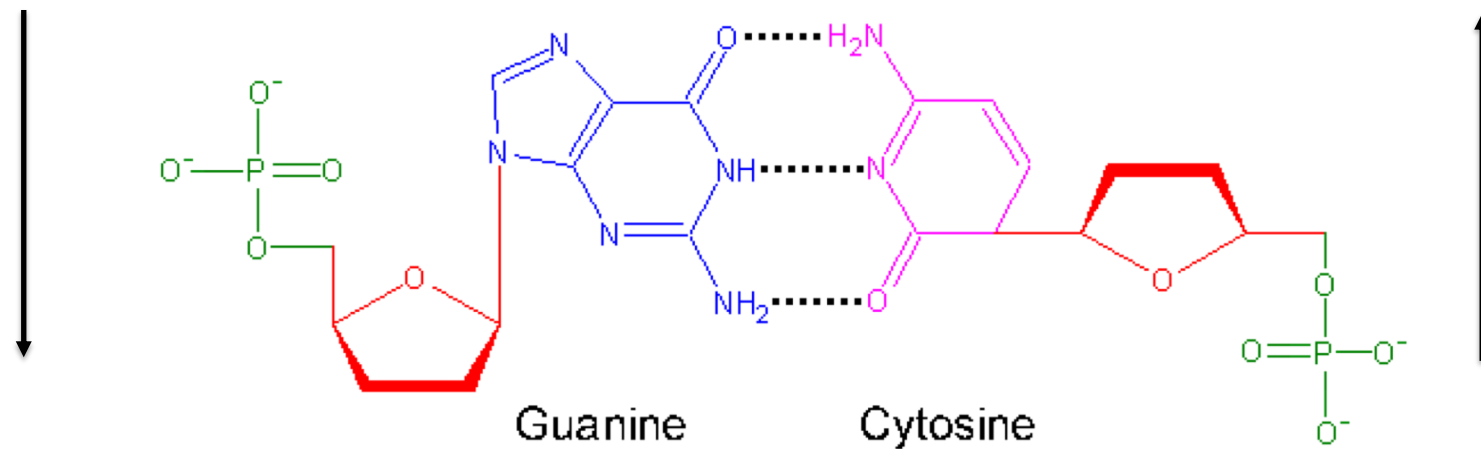
BASE PAIRS

DNA bases are connected with hydrogen bonds.

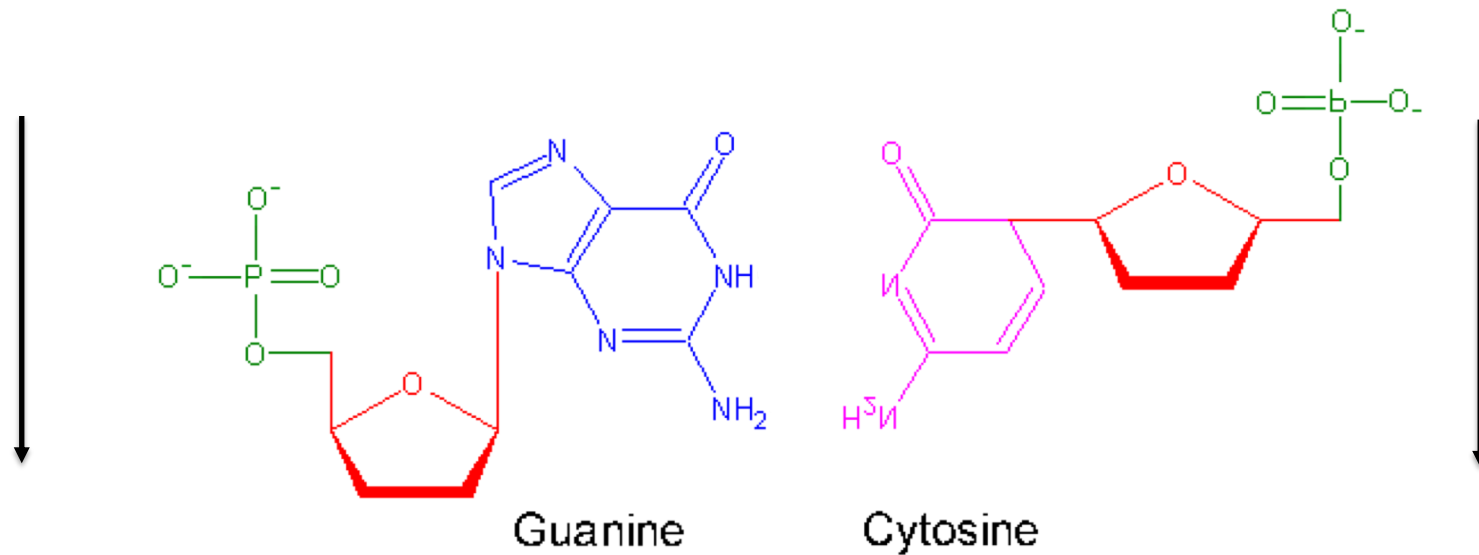


In DNA, adenine ALWAYS pairs with thymine, and guanine ALWAYS pairs with cytosine.

Why DNA strands must be antiparallel ?



Guanine and Cytosine can pair only
when antiparallel



Parallel strands : **G** and **C** cannot form hydrogen bonds.

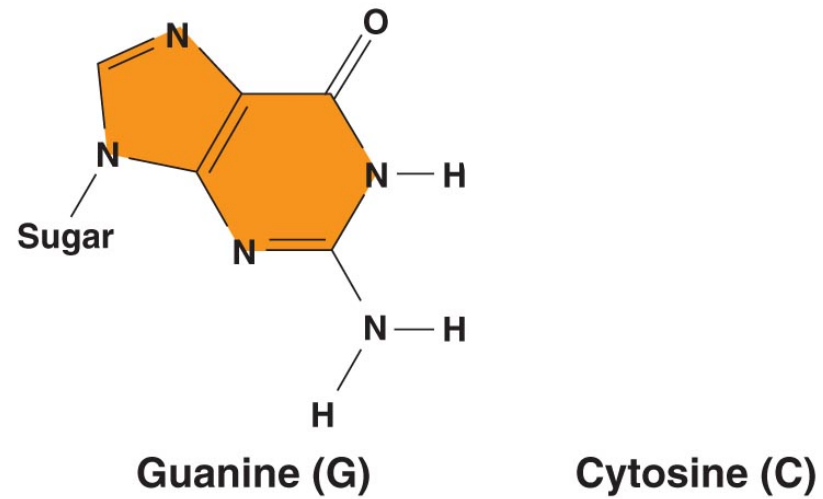
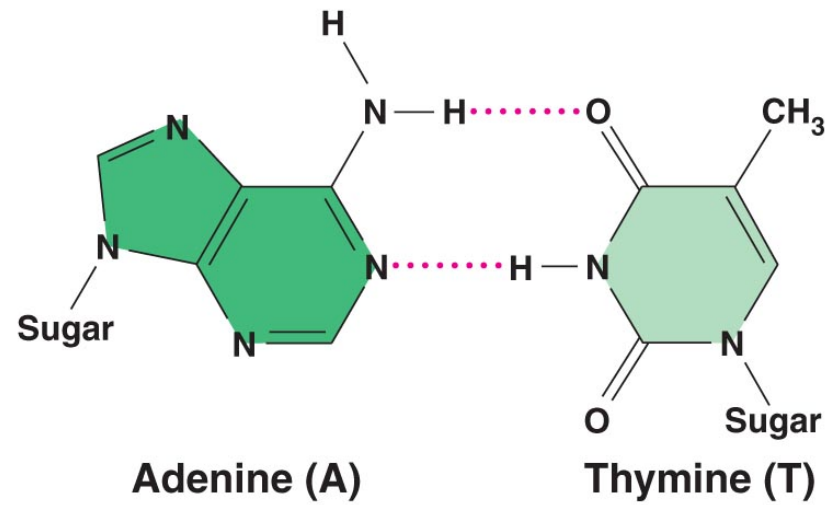


Fig 16.8

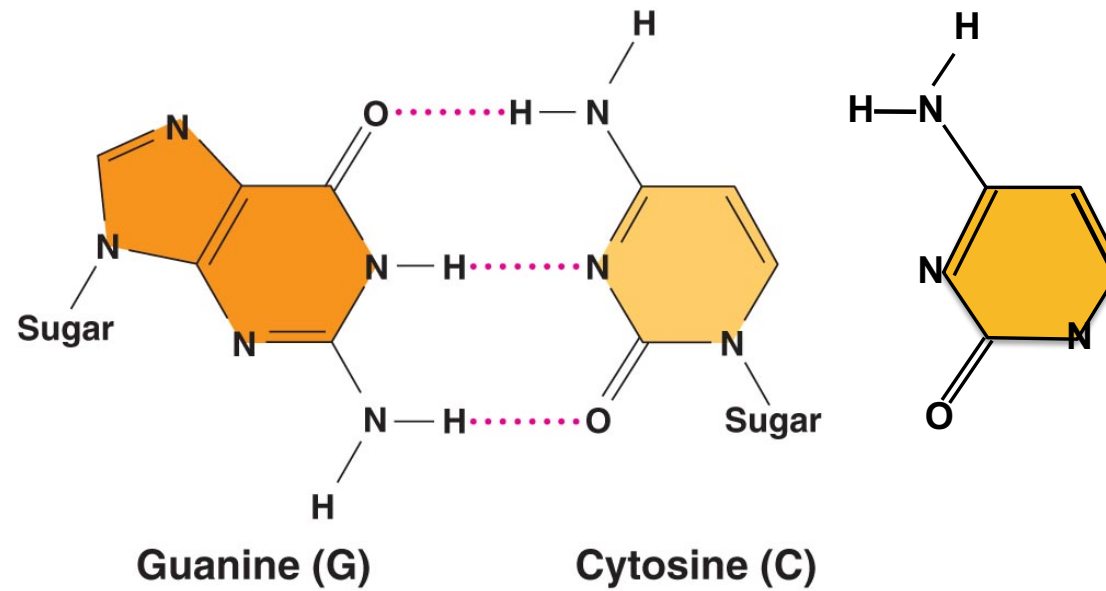
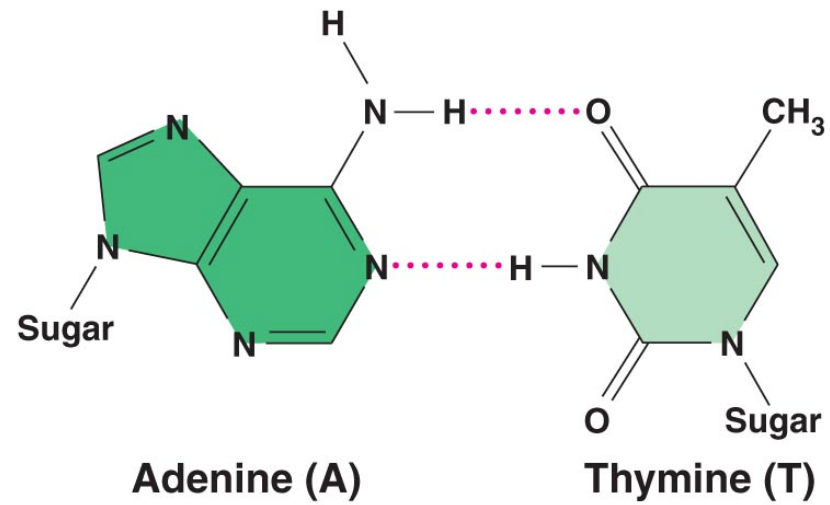


Fig 16.8

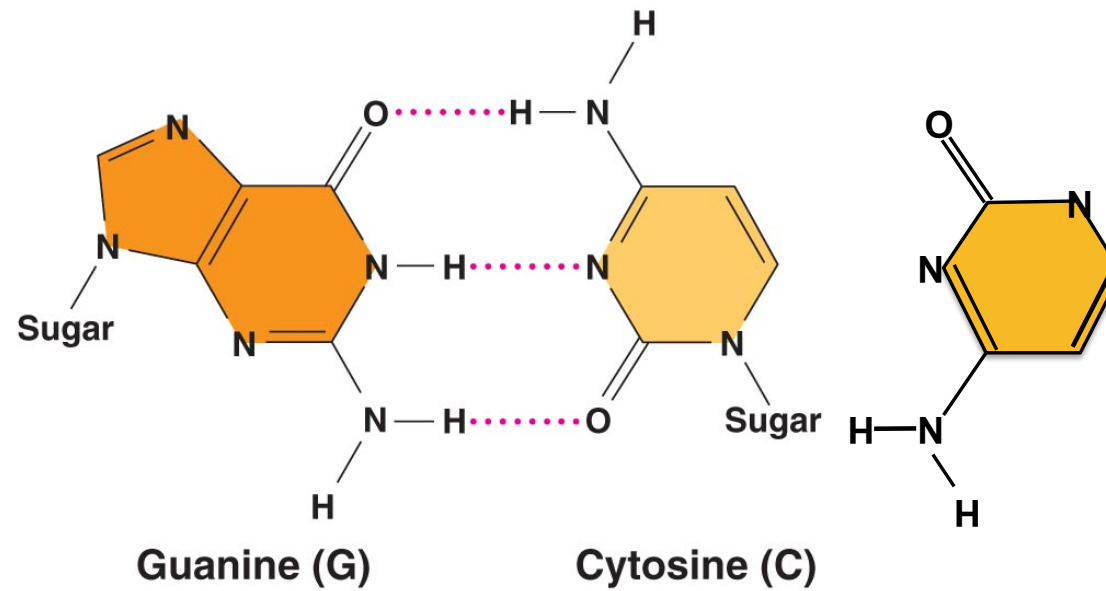
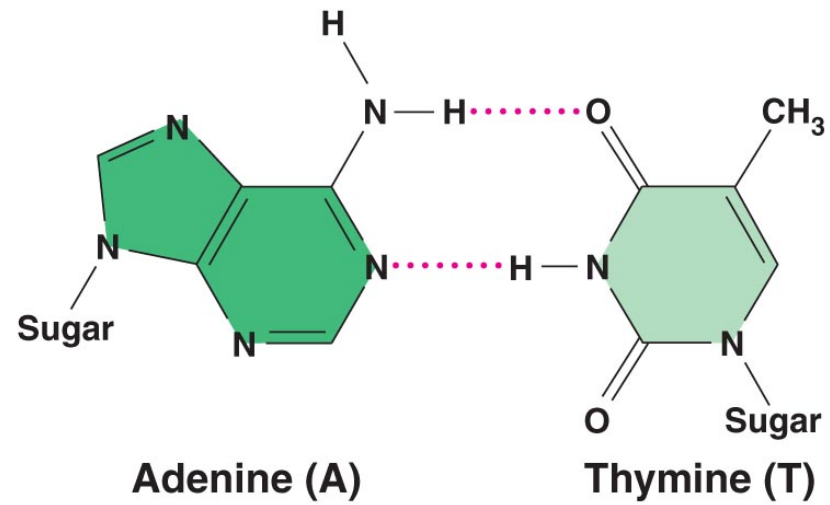


Fig 16.8

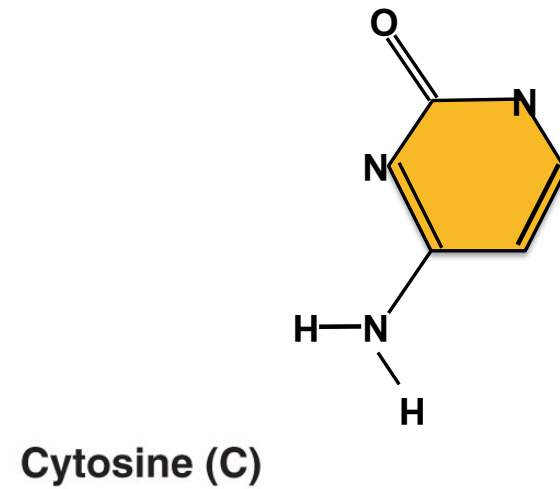
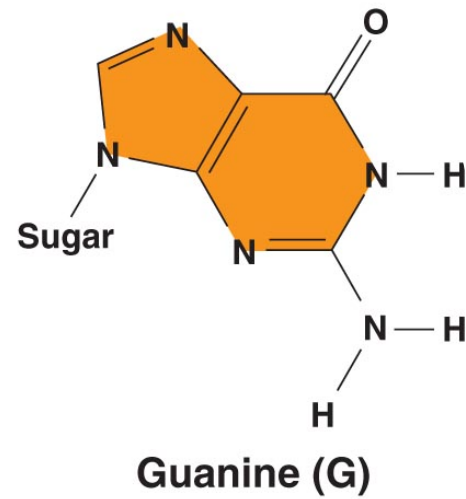
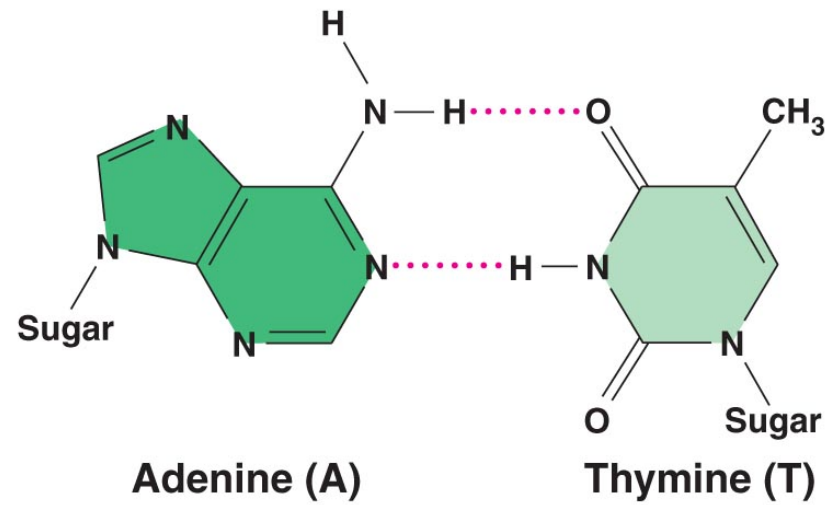


Fig 16.8

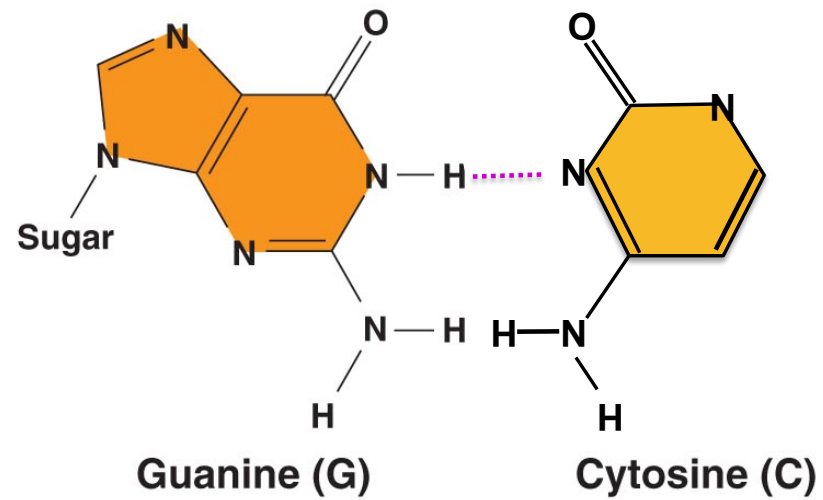
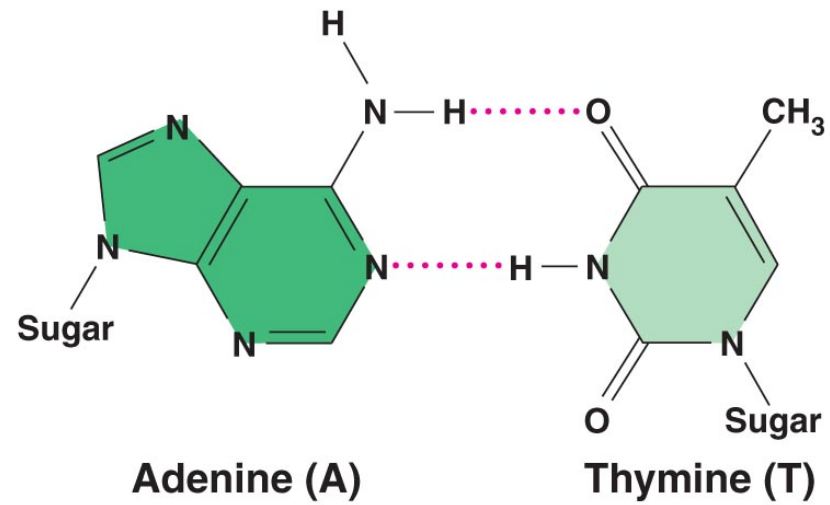
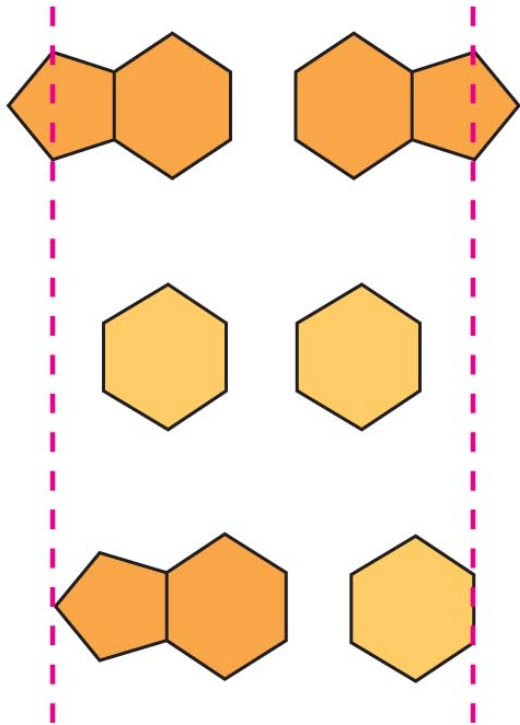


Fig 16.8

Bases pairing rule : purine with pyrimidine



Purine + purine: too wide

Pyrimidine + pyrimidine: too narrow

Purine + pyrimidine: width consistent with X-ray data

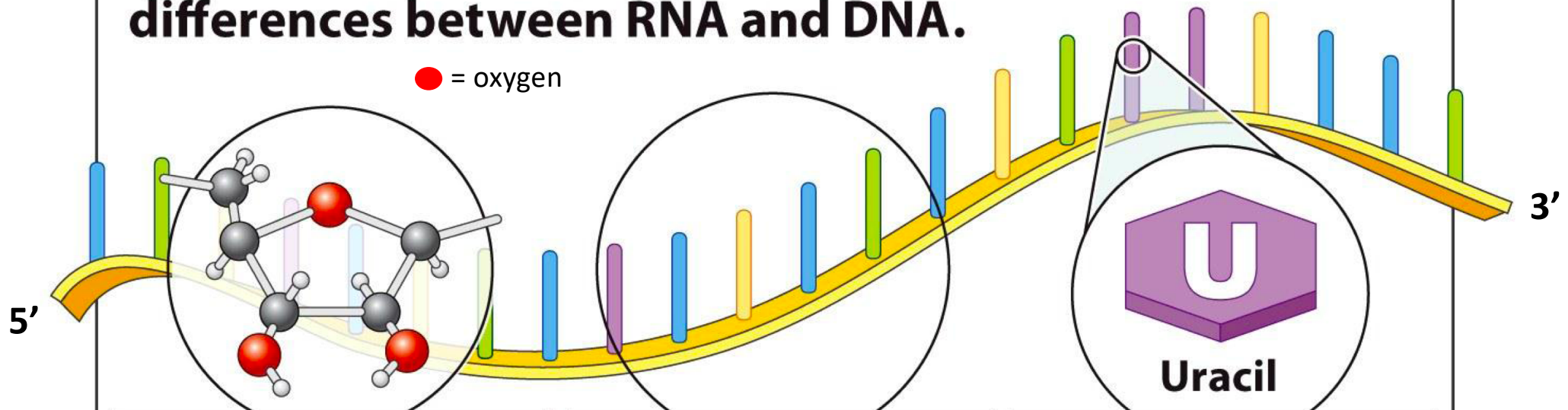
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RIBONUCLEIC ACID (RNA)

RNA STRUCTURE

There are three important structural differences between RNA and DNA.

● = oxygen



The sugar molecule in the RNA backbone contains an extra oxygen.

RNA has only one sugar-phosphate backbone, while DNA has two.

Instead of thymine, RNA has a similar base called uracil.

RIBONUCLEIC ACID (RNA)

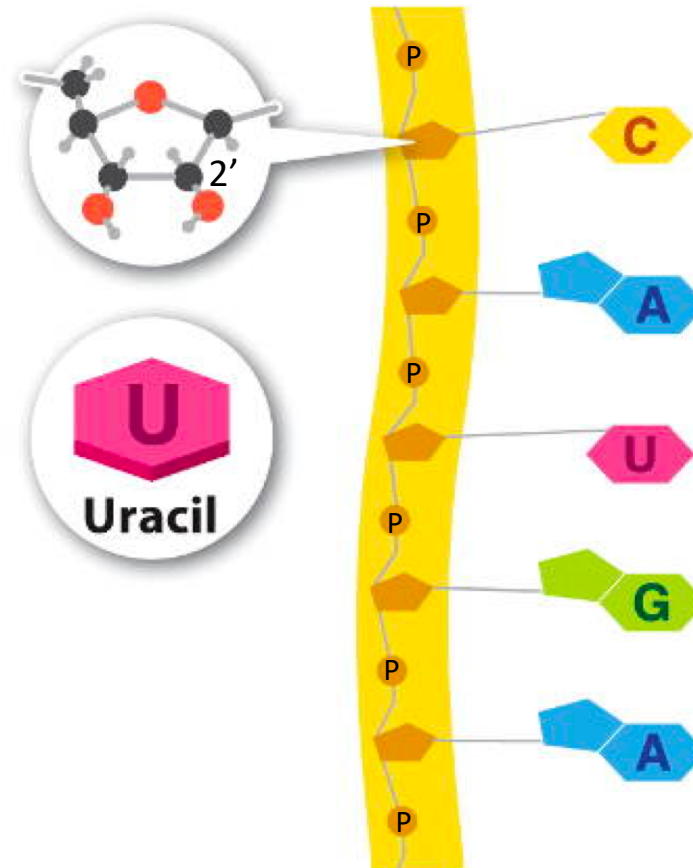
RNA STRUCTURE

- The sugar molecule in the RNA backbone contains an extra oxygen.

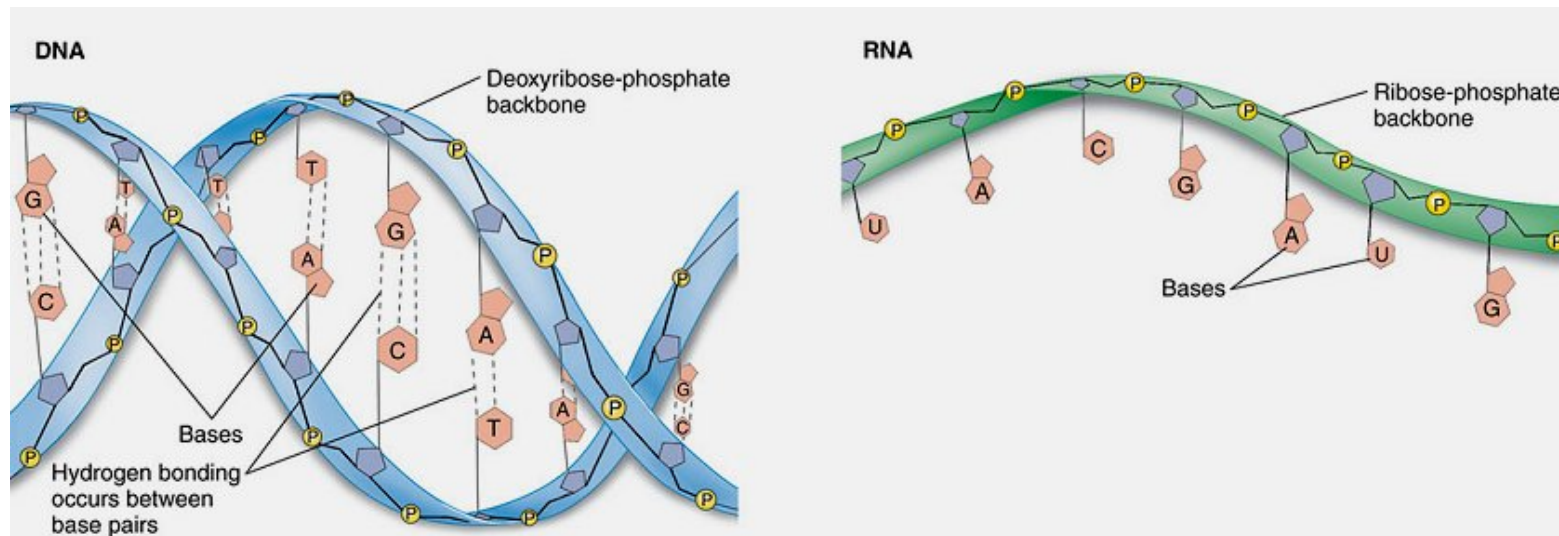
on carbon 2'

- Instead of thymine, RNA has a similar base called uracil.

● = oxygen



Differences between DNA and RNA

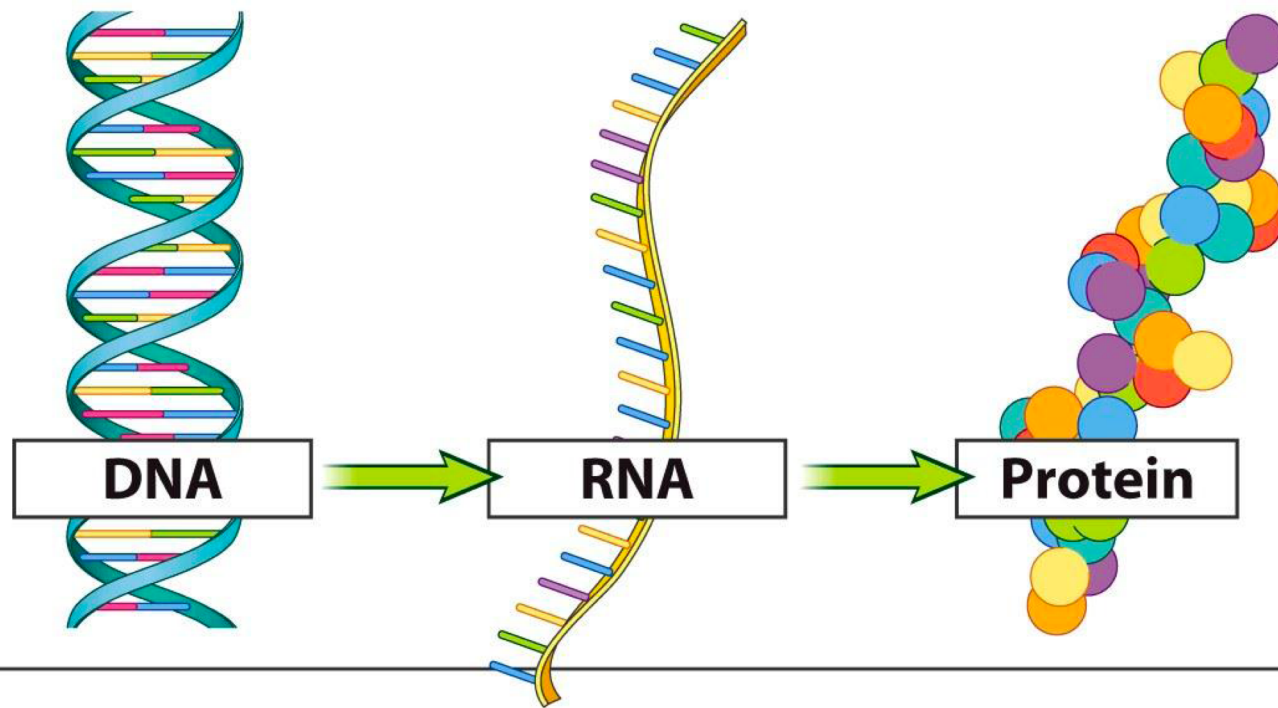


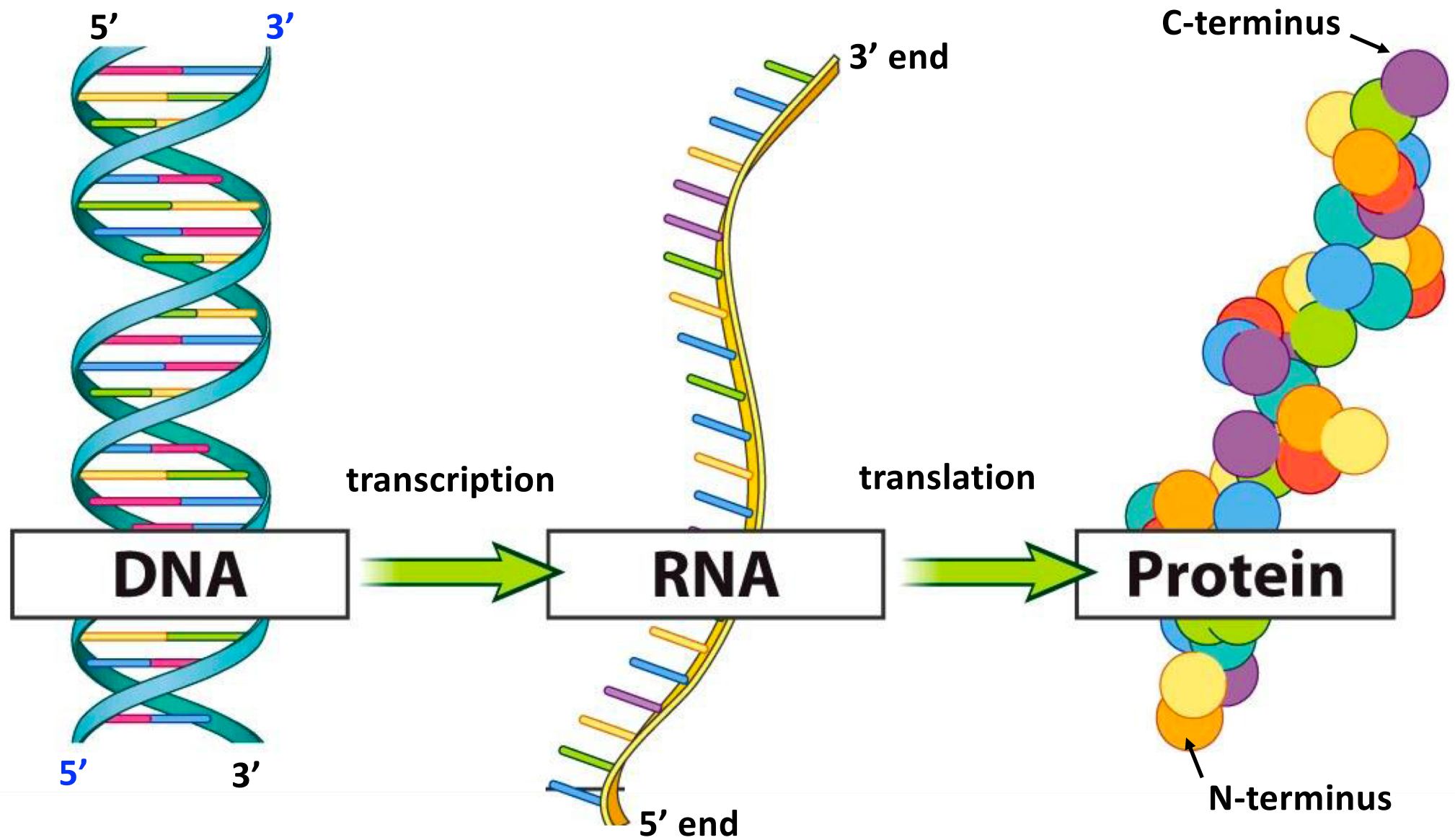
Sugar :	desoxyribose	ribose
Base :	Thymine	Uracil
Structure :	double stranded (mostly)	Single stranded (mostly)

RIBONUCLEIC ACID (RNA)

RNA FUNCTION

RNA acts as a middleman molecule. It takes instructions for production of a protein from DNA, moves them to another part of the cell, and directs the building of a protein.



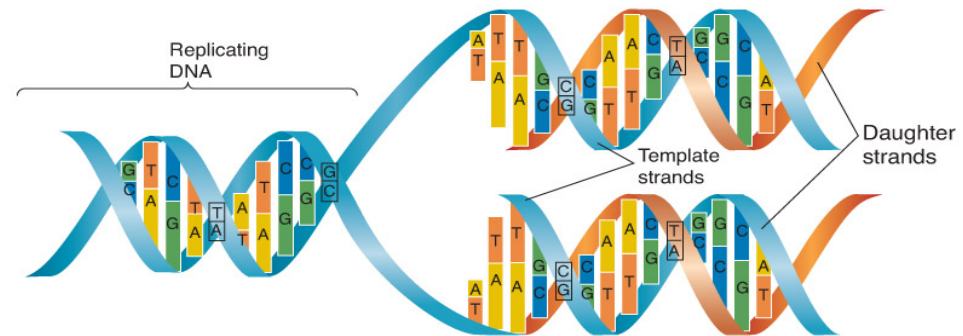


Overview

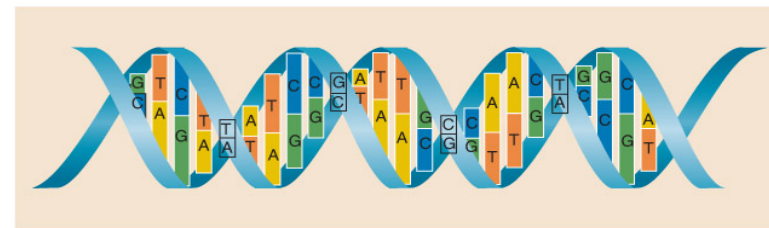
Copy
(replication)

Gene
Expression

(a) Replicating DNA



(b) DNA



↑
REPLICATION of each
complementary DNA strand

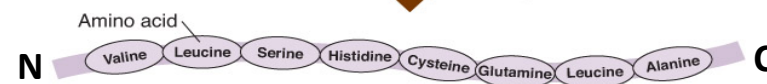
(c) Messenger RNA



↓
TRANSCRIPTION of a
DNA template strand

transcription

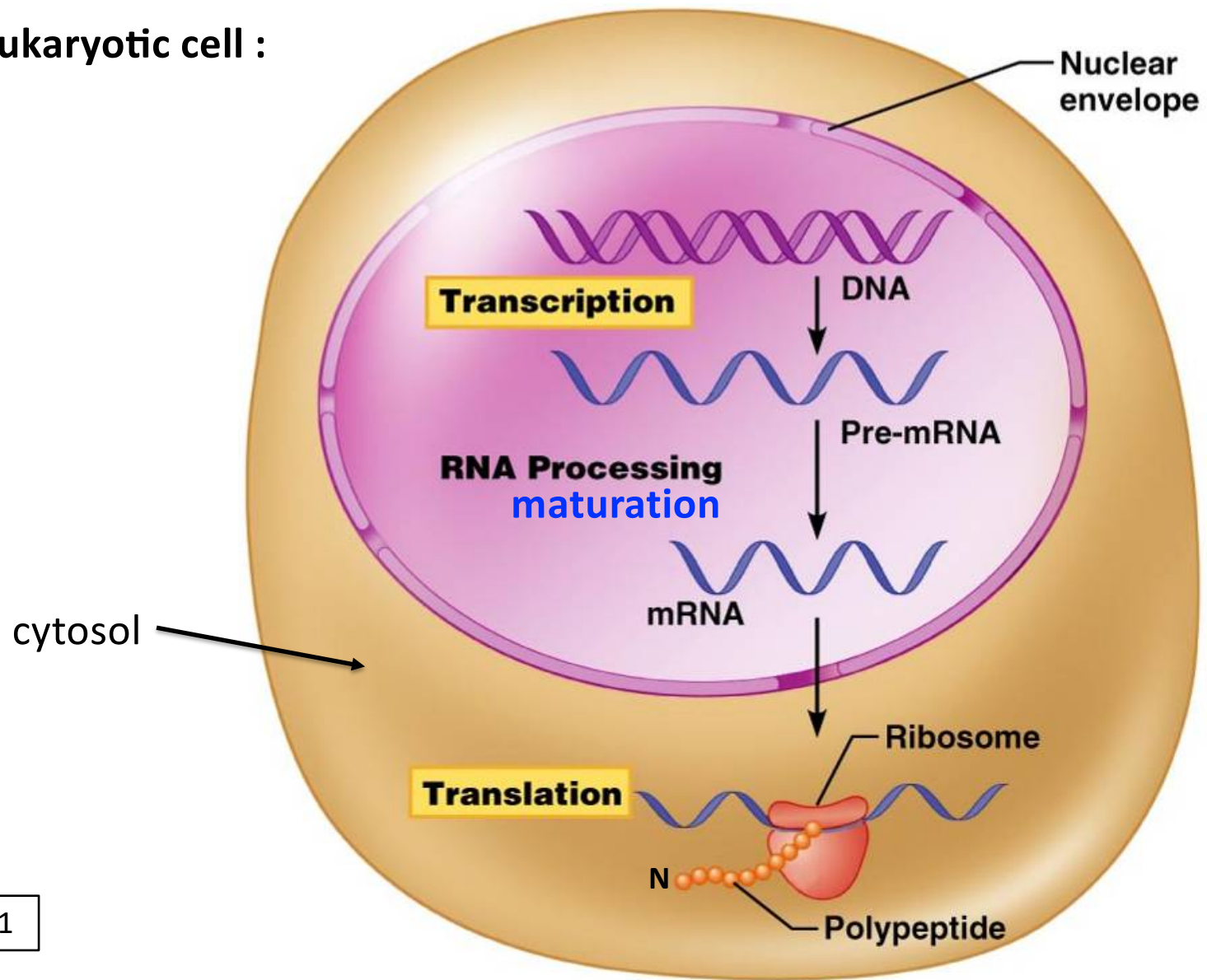
(d) Polypeptide



↓
TRANSLATION of
messenger RNA

traduction

In a eukaryotic cell :



See tutorial 9.1 part 1